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Polygonal Craters on Dwarf-Planet Ceres

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1. Introduction

With approximately 950 km diameter and a mass of ∼1/3 of the total mass of the asteroid belt, (1) Ceres is the largest and most massive object in the Main Asteroid Belt. As an intact proto-planet, Ceres is key to understanding the origin and evolution of the terrestrial planets [1]. In particular, the role of water during planet formation is of interest, because the differentiated dwarf-planet is thought to possess a water rich mantle overlying a rocky core [2].

The Dawn space craft arrived at Ceres in March this year after completing its mission at (4) Vesta. At Ceres, the on-board Framing Camera (FC) collected image data which revealed a large variety of impact crater morphologies including polygonal craters (Figure 1). Polygonal craters show straight rim sections aligned to form an angular shape. They are commonly associated with fractures in the target material. Simple polygonal craters develop during the excavation stage when the excavation flow propagates faster along pre-existing fractures [3, 5]. Complex polygonal craters adopt their shape during the modification stage when slumping along fractures is favoured [3]. Polygonal craters are known from a variety of planetary bodies including Earth [e.g. 4], the Moon [e.g. 5], Mars [e.g. 6], Mercury [e.g. 7], Venus [e.g. 8] and outer Solar System icy satellites [e.g. 9].

2. Data

We will use FC images and a mosaic of this data set to interpret the distribution and geologic setting of polygonal craters at highest available resolution.

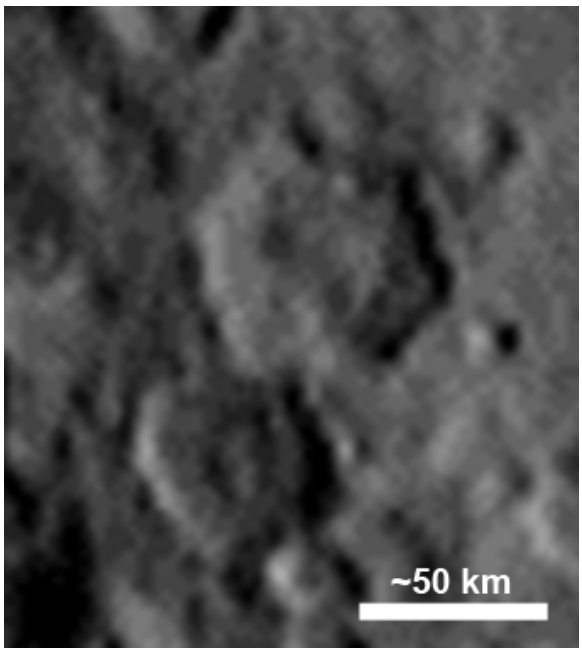

Figure 1: Polygonal craters on Ceres (reference: f2_477657691, stretched).

3. Method

By analysing the morphology and distribution of polygonal craters we aim to infer structural information on Ceres' surface material. We will analyse the geologic units with respect to polygonal crater density, orientation and morphology. Based on the assumption that polygonal craters are caused by fractures in the impacted material [5], structural regolith variations as well as tectonic conditions of surface units will be discussed.

4. Preliminary Results

On Ceres, we find polygonal craters with a size of up to 250 km in diameter and with the lower limit currently being restricted by the image resolution of $\sim$3.6 km/pixel. A preferential hexagonal shape is observed and some polygonal craters exhibit central peaks or relaxed crater floors. Areas showing an increase in polygonal crater density are observed on global scale. We will detail these findings with latest data available at the meeting.

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